

| | | |
|--|---|--|
| CECW-EG Engineer Regulation 1110-1-1901 | Department of the Army U.S. Army Corps of Engineers Washington, DC 20314-1000 | ER 1110-1-1901 22 February 1999 |
| | Engineering and Design PROJECT GEOTECHNICAL AND CONCRETE MATERIALS COMPLETION REPORT FOR MAJOR USACE PROJECTS | |
| | Distribution Restriction Statement Approved for public release; distribution is unlimited. | |

| Report Documentation Page | | |
|---|--|--|
| Report Date 22 Feb 1999 | Report Type N/A | Dates Covered (from... to) - |
| Title and Subtitle Engineering and Design: Project Geotechnical and Concrete Materials Completion Report for Major USACE Projects | Contract Number | |
| | Grant Number | |
| | Program Element Number | |
| Author(s) | Project Number | |
| | Task Number | |
| | Work Unit Number | |
| Performing Organization Name(s) and Address(es) Department of the Army U.S. Army Corps of Engineers Washington, DC 20314-1000 | Performing Organization Report Number | |
| Sponsoring/Monitoring Agency Name(s) and Address(es) | Sponsor/Monitor's Acronym(s) | |
| | Sponsor/Monitor's Report Number(s) | |
| Distribution/Availability Statement Approved for public release, distribution unlimited | | |
| Supplementary Notes | | |
| Abstract | | |
| Subject Terms | | |
| Report Classification unclassified | Classification of this page unclassified | |
| Classification of Abstract unclassified | Limitation of Abstract UU | |
| Number of Pages 21 | | |

CECW-EG

**DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, DC 20314-1000**

ER 1110-1-1901

Regulation
No. 1110-1-1901

22 February 1999

**Engineering and Design
PROJECT GEOTECHNICAL AND CONCRETE MATERIALS
COMPLETION REPORT FOR MAJOR USACE PROJECTS**

1. Purpose. The purpose of this regulation is to establish the requirement for documenting, as part of the permanent project record, the as-constructed geotechnical and concrete materials aspects of all major, complex and unique engineered projects constructed by USACE. Major construction projects are those that fall in the category of multi-million dollar, multi-purpose projects including all embankment and concrete dams and their appurtenant structures, and/or any structure for Civil Works projects involving more than 25,000 cubic yards of concrete. Unique and complex construction projects for both Military and civil works projects include those which, regardless of size or cost, which (a) had unusual or very stringent design requirements or performance criteria, (b) and/or encountered difficult or unusual foundation, concrete or other geotechnical challenges, or (c) for which unique or innovative design procedures, construction procedures or materials were utilized. It is further the intent of this regulation that existing project documentation be revised to include the as-constructed geotechnical and concrete aspects of all subsequent major modifications. In the absence of existing documentation, the project completion report for major modifications should be expanded to capture available information for both the original construction and the modification.

2. Applicability. This regulation applies to all HQUSACE elements, major subordinate commands (MSC), districts, laboratories, and field operating activities having responsibilities for planning, design, and construction of civil works and/or military construction projects. "Foundation Completion" documentation pertains to both civil works and military construction projects while "Embankment Criteria and Performance Evaluation" and "Concrete Materials" pertain only to civil works projects.

3. References.

- a. AR 70-31, Standards for Technical Reporting.
- b. AR 335-15, Management Information Control System.
- c. TM 6-370 (CEWES), Test Data, Concrete Aggregates and Riprap Stone in Continental United States and Alaska.

This regulation supercedes ER 1110-1-1801, dated 15 Dec 1981; ER 1110-2-402, dated 6 Aug 1990; ER 1110-1-1803, dated 19 Oct 1973; and ER 1110-2-1901, dated 15 Jun 1994.

ER 1110-1-1901
22 Feb 99

- d. ER 5-1-11, Program and Project Management
- e. ER 37-2-10, Accounting and Reporting Civil Works Activities.
- f. ER 1110-2-100, Periodic Inspection and Continuing Evaluation Of Completed Civil Works Structures.
- g. ER 1110-2-110, Instrumentation for Safety Evaluations of Civil Works Projects.
- h. ER 1110-2 1150, Engineering and Design for Civil Works Projects.
- i. EM 1110-2 1911, Construction Control for Earth & Rockfill Dams.
- j. EM 1110-2 2000, Standard Practice for Concrete for Civil Works Structures.
- k. EM 1110-2 2300, Earth and Rock-Fill Dams – General Design and Construction Considerations.

4. Distribution. Approved for public release, distribution is unlimited.

5. Background and Scope. The report is to be a professional quality, permanent, documentary summary record of project design, construction, early stage operation and modifications. The report will include relevant design data, design assumptions, design computations, specification requirements, construction equipment, construction experience, field control and record tests, early stage project performance evaluation and “lessons learned”. The report will provide, in a single document, the significant information needed by the sponsor, USACE technical staff and other team members to familiarize themselves with the project; to facilitate accurate, timely inspections and performance evaluations; and to serve as the basis for developing and implementing appropriate, effective modifications, "flood fighting" efforts, emergency and/or remedial actions to prevent or required as a result of unsatisfactory performance. As a critical part of the project record, this document will be a part of the Project Management Plan (PMP). The information and data in this document should be presented to and discussed with the sponsor/owner. For civil works projects, the information and data in this document should be used to provide the basic information for the appropriate sections of Periodic Inspection Reports. Additionally, information contained in this report can be used as a resource for design, construction, evaluation or modification of similar projects.

6. Authors. The usefulness of the various sections of the project completion report are dependent upon completeness and accuracy of the information contained in them. The authors of this report should have first hand knowledge of the project design and construction. Where possible, the authors should be the resident geotechnical or embankment engineer, the materials or concrete engineer and/or engineering geologist on the project during construction. Additionally, the geotechnical engineer(s), the materials or concrete engineer(s) and engineering geologist(s) responsible for the original design and performance evaluation should collaborate in the report.

7. Information to be Documented. Information to be presented should be grouped into the following major sections: (a) General, (b) Foundation Construction Section, (c) Embankment Criteria and Performance Evaluation Section, and (d) Concrete Materials Section. The last three are the categories formerly required as separate reports by the regulations superseded by this regulation. The report should include as many drawings, photographs, summary tables, and design summary plots as needed to accurately and effectively describe the project and its design, construction and operational history. It should be fully illustrated with foundation plans, geotechnical maps and sections supplemented by photographs, all of which clearly depict foundation conditions; embankment placement including earth- and rock-fill, stone protection and drainage material as well as placement and compaction equipment; and concrete plant, material sources, stockpiles and placement taken at the times the structures were placed. The report sections are described in subsequent subparagraphs. A suggested topical outline is shown in Appendix A. Only those sections appropriate to each specific project will be utilized.

a. **General.** This section should describe the purpose, location and history of the project, design, construction, and operation; the site geology; significant design assumptions, analyses, and decisions; special contract construction requirements; the important construction activities and modifications; an overview of operations, maintenance and any major modifications. The report should include a comparison of the information obtained during the feasibility and design stages with that obtained during construction.

b. Foundation Construction Section.

(1) The Foundation Construction section should (a) present a complete record of those geologic conditions at the project site that pertain to engineering including pertinent design values for the soil and rock material; (b) relate all field and laboratory methods of obtaining that information and give results of any tests that were performed; (c) briefly review the foundation design and describe changes and contract modifications made during construction together with the reasons for making those changes; (d) describe the methods employed and any problems encountered in excavating, preparing, and treating the foundations; (e) give information on type, depths, and driving of piles where structures are founded on piles and include pile driving records and load tests and descriptions of conditions after the piles are driven; (f) provide details on the excavation and placement of drilled piers; large or unusual footings or high performance foundations; (g) describe excavation methods and equipment used and support systems installed, and any problems encountered in construction of tunnels and underground structures; (h) review the soil or rock conditions on which individual components of the structure were placed; and (i) point out conditions that may require observation and treatment during operation of the project, such as those conditions that possibly could lead to development of leakage, development of uplift pressures, development of slides or settlement in the foundation materials, mechanical and chemical deterioration of riprap stone, or abnormal erosion of spillway and outlet channels. The report should include a comparison of the information obtained during the feasibility and design stages with that obtained during original construction or subsequent modification.

(2) In describing either excavation or foundation construction operations, include the dates

when the operations were performed, quantities and locations of material excavated or of piles, drilled piers, or large footings emplaced and lists of equipment employed. Also, difficulties or problems encountered in the operations should be pointed out, and the methods employed to overcome those difficulties should be described. If blasting is employed in connection with excavation, the blasting system should be described including information on the kinds and the quantities of explosives used, the sizes of charges, the depths and the spacing of holes, delays used, descriptions of any overbreakage, special procedures such as smooth wall blasting or pre-splitting, and other pertinent data. All pertinent data on curtain or consolidation grouting should be included as well as information on relief drain facilities and associated instrumentation.

(3) All exploratory and other soil and rock samples and core not used for testing will be preserved and stored in a protected storage facility until discarded. Exploratory or other rock core, regardless of age, will be retained until the detailed logs, photographs and test data have been made a matter of permanent record in the Project Geotechnical and Concrete Materials Completion Report. All samples and core will be retained until full and final settlement of all obligations and claims has been made with all contractors and others. Samples and cores related to contemplated additional, future construction and a few selected cores representative of foundation and abutment conditions will be retained for a minimum of five years after final completion of the project, provided no unforeseen foundation or abutment conditions have developed. If a proposed project is deauthorized or is otherwise disapproved, all samples may be discarded. Samples and cores will be discarded in an environmentally responsible manner.

c. Embankment Criteria and Performance Evaluation Section. The narrative and data to be included in the Embankment Criteria and Performance Evaluation section should expand on and complement the information given in the preceding sections including the engineering properties of the bedrock and foundation and embankment soils; the significant design assumptions, analyses, and decisions on the foundation treatment and embankment design; relevant, special contract construction requirements; important construction activities and modifications; the instrumentation installed, threshold and action levels, and interpretation of the instrumentation data; a discussion of predicted performance, performance parameters, a summary of significant operational events, observed performance of the embankment, foundation, and abutments and a performance evaluation summary. The written text should be as brief as practical, with the main presentation consisting of photographs, drawings, tables, graphs, data summary and instrumentation plots.

d. Concrete Materials Section.

(1) The concrete materials section should be written to fulfill the objectives of providing information to those who may investigate problems with concrete on the project in the future, those embarking on design of similar projects, or those periodically inspecting the project. The concrete materials section should include discussions on problems encountered in each phase of concrete production and placement, including the production of aggregates. The solution of those problems should be summarized.

(2) Information to be included in the concrete materials section consists of:

(a) Aggregate sources. Name of each aggregate source used for the concrete with coordinates, and/or street or township of the pit or quarry should be provided. If test data are available in TM 6-370 (CEWES), the volume, area, and index numbers should be included. Drawings or photographs to indicate the exact location within the pit or quarry from which the aggregate was produced should be provided.

(b) Aggregate production and stockpiling. Photographs and a flow chart showing the sequential processing of fine and coarse aggregate should be included. The major equipment used should be listed by make, model, and capacity. The particle shape of coarse aggregate should be discussed. In case of quarry, the most commonly used blasting pattern should be detailed to include blast hole spacing and depth, powder types and requirements, and powder factor. The number of stockpiles and sizes of coarse aggregate in each stockpile should be noted. The approximate size of the stockpile during normal aggregate production and concrete placing should be noted. If a stockpile was reduced to a very low level during the placing of concrete, the time of this occurrence should be noted. The equipment used to move aggregate to and from the stockpile should be noted.

(c) Cementitious materials. The sources of portland cement, blended hydraulic cement (if used on the project), pozzolan, ground granulated blast-furnace (GGBF) slag and silica fume (if used on the project) should be listed. The dates of cement used from each source and the approximate locations of their use should be noted. The means of transporting the cement to the project site should be noted and the transfer and storage facilities described. If commercial source was used for pozzolan, the location of the firms supplying the pozzolan should be listed. If a source of natural pozzolan was developed and used by the contractor or if a natural source was opened nearby by a commercial operator to supply pozzolan to the project, the location of the source should be provided and the processing requirement outlined. If silica fume or GGBF were used only in certain locations on the project, the locations, dates placed, and mixtures proportions should be included.

(d) Chemical admixtures. The brand names, sources, and available test data of all chemical admixtures used on the project should be listed including the structure feature in which these were used.

(e) Concrete. Information regarding concrete production and placement should include the following: (1) the concrete batching and mixing plant should be described to include, make, model, and capacity of major bins, conveyor belts, hopper mixers, and controls; (2) the proportions of the concrete mixtures used during the bulk of placement of each major class should be tabulated, the aggregate batch weights should be reported at saturated surface dry, if significant field adjustment were made to the concrete mixtures, the extent of the adjustment should be noted and reasons for adjustment discussed; (3) the equipment and technique used for joint preparation should be described; (4) the type and capacity of equipment used to transport the concrete from the mixer to the placement site should be described, the means of placement should

be described and the number and type of vibrators noted, the normal and maximum rates of placement of each major class of concrete on project should be listed; (5) a brief description should be provided outlining the contractor's selected means of curing and protecting the concrete, any mishaps which occurred during curing and protection which may have reduced the level of protection or truncated the curing process on parts of major structures should be noted; (6) the description of temperature control measures used on the project will include the types of insulation used, the major components of any required pre- or post cooling systems, the dates that various control measures were used during the construction period, and any mishaps which resulted in deviations from the specified control requirements; (7) on any project that includes concrete different than cast-in-place mass or structural concrete, a section should be provided detailing the materials used, method of placement, problems encountered, and how these were solved; (8) the type, description, name and location of the manufacturer of the precast units used on the project should be provided; (9) the procedure and the extent of Government Quality Assurance (GQA) program and the Contractor Quality Control (CQC) program should be described, the types and the frequencies of tests and quality verifications performed by the Government for GQA purpose and by the contractor for CQC should be described; (10) a summary of all GQA and CQC test data should be provided, charts should be used where possible, charts and tables should show average of the values presented as well as extremes and the specification limits; (11) any unusual problems encountered during the concrete construction and corrective action taken should be described, any comment or evaluation of the results should be provided or documented. For additional details on preparing the concrete materials section, consult EM 1110-2-2000, Standard Practice for Concrete for Civil Works Structures.

8. Time of Completion. Records, notes and data for the reports should be made during design, the composite report should be completed as soon as possible following the initial reservoir filling to normal pool elevation but should not exceed one year following the completion of dam construction. For all other projects, the composite report should be completed as soon as possible following construction completion.

9. Funding. Funding for report preparation should be in accordance with ER 37-2-10 for all civil works projects and in accordance with guidance for preparing as-built drawings for all other projects. The costs for report preparation should be included in the PMP.

10. Disposition of Reports.

a. **Civil Works Projects.** Upon completion, review and approval by the District, a copy of the completed report should be retained by the District as part of the Project Management Plan (PMP), one copy should be retained as part of the Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures record and one copy should be made a part of the permanent project records stored at the project office. Additionally, the report should be distributed in hard copy format as follows:

| | |
|---------------|----------|
| Sponsor/Owner | 2 copies |
|---------------|----------|

| | |
|---------------|---------------|
| Each MSC | 1 copy (each) |
| CEWES-IM-MI-T | 1 copy |
| CECW-EG | 2 copies |

b. Foundation Construction Reports for Military Construction Projects.

(1) RCS exempt, AR 335-15, paragraph 5-2e (8).


(2) Defense Technical Information Center @TIC). Twelve (12) copies (if available) of unclassified and unlimited or 2 copies of classified and/or limited will be sent to DTIC/DA-2, Cameron Station, Alexandria, VA 22314. Reports submitted to DTIC will contain DD Form 1473 (Report Documentation Page) prepared in accordance with AR 70-31. Distribution limitation statements will be applied in accordance with AR 70-31.

(3) Additionally, the report should be distributed in hard copy format as follows:

| | |
|---------------|---------------|
| Each MSC | 1 copy (each) |
| CEWES-IM-MI-T | 1 copy |
| CEMP-ET | 1 copies |

FOR THE COMMANDER:

1 Appendix
APP A - Outline for Project Geotechnical and
Concrete Materials Completion Report



ALBERT J. GENETTI, JR.
Major General, USA
Chief of Staff

APPENDIX A
OUTLINE FOR PROJECT GEOTECHNICAL AND CONCRETE
COMPLETION REPORT

i. Title Page(s):

ii. Table of Contents:

1. General Section: Should include an introduction and overview of the project. State the authority for and purposes of the report. Briefly describe the project purpose(s); location; major project features and structures; construction authority; construction phasing; history of construction contracts; contractors, supervision and Quality Control organization; key resident and design staff; special design and/or construction considerations; and significant operational events. The narrative should refer to applicable drawings, photographs, tables, and plates.

a. Introduction

b. Pertinent Data Sheet: (Use format similar to existing Data Sheets.)

c. Location and Vicinity Map

d. General Plan

e. Site Description. Briefly describe the site; topography; geomorphology, discuss the historic, regional and site physical geology including physiography; stratigraphy and basic structural (structure, jointing, discontinuities, weathering, ground water, leaching and/or solution activity) and engineering properties of the bedrock. The origin and deposition of overburden materials, as well as their engineering classification, properties, and relative locations, should be discussed. Also, outline the type, number, extent, and purpose of the underground exploration program. Unusual or unanticipated geologic conditions encountered during construction should be presented.

f. Foundation Investigations: (Under both headings, include dates when explorations were made and purpose of explorations; as well as kind, quantities, and particular problems or difficulties, and tests performed).

(1) Investigations prior to construction (including testing).

(2) Investigations during construction.

g. Overview Photograph(s) of Completed Project. (An aerial view should be included, if available)

2. Foundation Construction. Discuss the reasons for the types of foundation and abutment treatments selected, such as grouting and cut-off trenches, and dental treatment. Present the area of depth limits of treatments, construction procedures employed, construction quantities involved, and the evaluated effectiveness of the treatment.

a. Special design and/or construction considerations

b. Foundation Excavation Procedures

(1) Excavation grades as-designed and as-built.

(2) Dewatering provisions include methods, quantities and effectiveness.

(3) Overburden excavation: include description of any support required during excavation, disposition, and processing.

(4) Rock excavation; include blasting plans, powder factors, results, problems, use of materials.

(5) Line drilling, pre-splitting, and contour blasting.

(6) Foundation preparation; include protection of weather-sensitive materials.

(7) Safety precautions against slides and rock falls: rock bolts and tiebacks.

c. Pile Driving, Construction of other Foundations for Structures and Special Foundations.

d. Tunnels, Shafts and Underground Structures.

e. Foundation Anchors and Rock Bolts: Temporary and permanent, include type, anchorage, and grouting materials.

f. Character of Foundation

(1) Foundation surface.

- (2) Condition of foundation soil or rock (engineering characteristics).
- (3) Water.
- (4) Special or unusual conditions.

g. Foundation Treatment

- (1) Grouting prior to concrete placement.
- (2) Curtain grouting (including methods, pressures, and evaluation).
- (3) Drainage provisions.
- (4) Foundation compaction or consolidation.
- (5) Dental concrete and 'broom' grouting.
- (6) Other treatments and problems.

h. Rock Mass and/or Structural Foundation Instrumentation

- (1) Purpose.
- (2) Structures.
- (3) Rock.
- (4) Results tabulation.

i. Potential Future Problems

- (1) Conditions that could produce problems.
- (2) Recommended observations.

j. Record of Foundation Approval

3. Embankment Criteria and Performance Evaluation Section.

a. General. Present the general embankment features, including height, slopes, zoning, material properties, sources, location, design/construction considerations, materials usage in the

embankment, phasing and the slope protection design, material provided, and placement methods. Discuss consolidation testing results, embankment settlement and constructed over-build. Discuss compaction test results and material placement conditions specified for construction. Present material placement requirements specified, construction compaction equipment used, and significant placement activities for each zone of the embankment.

b. Slope Stability. Discuss, for both the foundation and embankment materials, the shear testing performed, shear test data results, selected design strengths, reasons for selecting the method or slope stability analysis used, the results or design cases analyzed for the embankment constructed, predicted performance, and performance evaluation.

c. Seepage Control. Discuss exploration and testing performed to determine assumptions for the seepage analysis. Present design assumptions, results of design analysis, and reasons for the seepage control design selected. Present special contract construction requirements and activities related to construction or seepage control features.

d. Diversion and Closure. Discuss the diversion and closure construction sequence, considerations, activities, and experiences.

e. Instrumentation. Discuss the overall instrumentation plan for the dam and its' foundation. Discuss the purpose of each set of instruments including the performance mode being monitored and why, load or event to which the instrument reacts or detects, the parameter being monitored and the relationship to performance, threshold limits or ranges, actions to be taken when threshold or action limits or ranges were reached or exceeded. Discuss the different kinds of instruments, special instruments, and significant details of installation of instruments. A discussion of actual versus predicted performance should be included.

f. Construction Notes. Present significant embankment construction history. Discuss changes in design details or construction procedures that became necessary during construction.

g. Operational Notes. Present embankment performance history since completion of construction.

h. Major Modifications. Describe, explain reason needed, construction and performance of major modifications to major project features accomplished since completion of original construction.

4. Concrete Materials Section.

a. Introduction

- (1) Purpose, scope, and authority
- (2) Project description
- (3) Concrete quantities by type
- (4) List of responsible personnel

b. Aggregate sources

- (1) General
- (2) Properties of sources used

c. Aggregate production

- (1) Pit or quarry operation
- (2) Fine aggregate production
- (3) Coarse aggregate production
- (4) Stockpiling and handling

d. Cementitious materials

- (1) Portland cement sources
- (2) Blended hydraulic cement sources
- (3) Pozzolan sources
- (4) GGBF slag
- (5) Silica fume

e. Chemical admixtures

- (1) Air-entraining admixtures
- (2) Water-reducing admixtures
- (3) Retarding admixtures

- (4) Accelerating admixtures
 - (5) Others
- f. Concrete batching and mixing plants
- g. Concrete mixtures used
 - (1) Mass concrete
 - (2) Structural concrete
 - (3) Special concrete (RCC, fibre reinforced, etc.)
 - (4) Shotcrete
- h. Construction joints preparation
- i. Concrete transportation, placement, and consolidation/compaction
 - (1) Concrete transportation
 - (2) Concrete Placement
 - (3) Shotcrete placement
 - (4) RCC placement
 - (5) Concrete placing schedule
 - (6) Concrete consolidation
 - (7) RCC compaction
- j. Concrete curing and protection
- k. Temperature control
 - (1) Insulation
 - (2) Pre-cooling
 - (3) Post-cooling

(4) Heating

l. Special Concretes

- (1) Fiber-reinforced concrete
- (2) Tremie concrete placed in cutoff walls
- (3) Tremie concrete in underwater applications
- (4) Other unusual applications of concrete or means of application
- (5) Roller Compacted Concrete

m. Precast concrete

n. Quality verification and testing

- (1) Government quality verification
- (2) Laboratory facilities

o. Summary and discussion of test data

- (1) Aggregate quality tests
- (2) Aggregate grading tests
- (3) Tests for cementitious materials
- (4) Tests for admixtures
- (5) Concrete strength tests
- (6) Concrete freeze/thaw
- (7) Air content tests
- (8) Slump tests
- (9) Vebe Tests (RCC)
- (10) Placing temperature

ER 1110-1-1901
22 Feb 99

(11) Resistance thermometer data

p. Special problems.

(1) Problem

(2) Actions

(3) Comments

Appendix I - Drawings

Appendix II - Photographs

Appendix III - Tables, Plots and Graphs

Appendix IV - Data Summary Sheets

Outline for Appendix I

DRAWINGS

- a. Location and Vicinity Map
- b. General Plan
- c. Site plan.
- d. Geologic map.
- e. Plan of explorations made prior to and during construction.
- f. Logs of core borings.
- g. Foundation map.
- h. Geologic profiles and cross sections (embankment foundation, control structure, abutments and spillway axis).
- i. Drilling and Grouting records, plans and profiles (showing areas of major takes, connections, surface leaks, etc).
- j. Foundation dewatering plan.
- k. Embankment plan with boring and instrumentation locations shown.
- l. Embankment cross sections with instrumentation shown.
- m. Embankment design, construction and phasing details.
- n. Embankment slope stability cross sections with design assumptions, critical failure surfaces and/or planes, and factors of safety shown.
- o. Embankment slope stability reevaluation, if necessary.
- p. Embankment seepage control design with assumptions, section, and selected design shown.
- q. Distribution of field control test locations. For each zone tested, plot a profile parallel

Outline for Appendix I

DRAWINGS

to the axis with field control test data plotted at the locations sampled.

r. Instrumentation installation details.

s. Interpretations of instrumentation data.

(1) Settlement profile or contour plan.

(2) Alignment profiles of measured movements.

(3) Embankment section with embankment and foundation pore pressure distribution or contours. It may be necessary to plot contour diagrams at various dates or fill stages.

(4) Embankment sections showing phreatic surface through foundation.

(5) Profile in relief well line showing well and piezometer locations, and measured and design heads.

Outline for Appendix II

PHOTOGRAPHS

(NOTE - photograph locations, view direction, main subject and date should be identified on photo titles).

- a. General views of damsite.
- b. Structural foundation photographs. Foundation stripping, excavation, treatment, and sequential foundation construction including photo of completed structure.
- c. Dam foundation. Sequential photos of stripping, excavation, treatment, etc.
- d. Construction equipment.
- e. Embankment construction. Sequential photos from foundation preparation thru top out including placement of slope protection.
- e. Instrumentation devices and installation details.
- f. Special items.

Outline for Appendix III

TABLES, PLOTS AND GRAPHS

- a. Embankment zone placement quantities.
- b. Embankment zone design placement requirements compared with summary of field control test data results.
- c. Graphic summaries of embankment and foundation design shear strength test data with selected design values shown.
- d. Summary of record control shear strength test results compared against embankment shear strength design assumptions.
- e. Plot of pool versus time.
- f. Plot of pool or fill elevation versus surface settlement point, settlement plate, etc.
- g. Plot of pool elevation versus piezometer levels.
- h. Plot of settlement versus time.
- i. Plot of pool elevation versus piezometer levels.
- j. Plot of fill elevation versus piezometer levels.
- k. Plot of piezometer levels versus time.
- l. Plot of pool or fill elevation versus inclinometer displacement.
- m. Plot of inclinometer displacement versus time for constant loading.
- n. Plot of pool elevation versus total relief well discharge quantities.
- o. On a relief well profile, the plotted quantities of flow measured at various depths in relief wells.
- p. Plot of pool elevation versus seepage weir discharge.
- q. Other significant performance parameters versus load and/or time.

Outline for Appendix IV

DATA SUMMARY SHEETS

- a. Foundation and Embankment materials testing
- b. Record Control Samples for Foundation and Embankment materials
- c. Aggregate quality tests
- d. Aggregate gradation tests
- e. Tests for cementitious materials
- f. Tests for admixtures
- g. Concrete strength tests
- h. Concrete freeze/thaw tests
- i. Air content tests
- j. Slump tests
- k. Vebe Tests (RCC)
- l. Placement temperature
- m. Resistance thermometer data